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FOUNDED BY WILLIAM HUNTING, F.R.C.V.S.

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CLINICAL PROBLEMS.

Recently we have had a number of contributions of varying length concerning a subject belonging to canine minor surgery—the condition known as "interdigital abscess." No one will call the subject a very important one; but all who engage in canine practice will be interested by the discussion upon it. Little concerning it is to be found in our text books; and that little is distinctly superficial. Still less, hitherto, has appeared in our journals. Its etiology is still obscure. Its treatment is very often unsatisfactory; and this, combined with its tendency to recurrence, renders it extremely troublesome. Lastly, it is comparatively common in everyday practice. It is one of numberless clinical subjects concerning which our present knowledge is deficient; and further discussion of it would be welcome.

But does not the last sentence suggest a wider question? How many other such subjects are there, all of more or less importance in practice, regarding which little has been written, and not much can be said to be generally known? All will agree that there are many; few, perhaps, realise how large the number really is. Only those who have studied our journals with more than usual thoroughness know how vast an amount of veterinary experience has never been recorded in their pages.

SWINE FEVER.

The Board of Agriculture has lost no time in following the recommendations of its Departmental Committee; and it is now possible for farmers to obtain free a serum for use against swine fever.

This is our first attempt to deal with the disease on other than stamping out lines; and a great deal will depend upon strict observance of the Board's regulations and restrictions. With such observance, it will be possible in two or three years' time to assess the value of the serum treatment in the field. Without it, we shall only have misleading and probably discouraging results. A good deal may have to be done in the way of supervising and educating farmers; and here is an opportunity for country practitioners to do good work. One who has acquainted himself with the details of the serum treatment, who recognises it for the present as being still largely in the experimental stage, and at the same time works to ensure it a fair trial in his district, may become a valuable auxiliary to the Board.

THE CHANNELS OF TUBERCULOUS INFECTION.

Calmette has published an important work upon this debated subject (*Office interne d'hygiène publ.*). After reviewing various opinions and recording different experiments, he arrives at the following conclusions.

Heredity. It is now definitely established that heredity has no preponderant influence in the transmission of tuberculosis. What is, in reality an infection of the ovum may occur, but it is exceptional; moreover, it is only possible to verify this from the maternal side. *There are no positive facts which establish that an individual may be procreated tuberculous by a tuberculous father.*

Placentar Infection. The passage of tubercle bacilli across the placenta in the human subject is exceptionally rare, and only constitutes a factor of minimal importance in the transmission of the disease. In veterinary medicine, it is not rare to find tuberculous lesions, which from their aspect and character should be regarded as of congenital placentar origin, in the livers of calves.

Infection by the Skin. The skin is the medium which offers the least favourable conditions for the settlement, penetration, and multiplication of the bacilli. For that reason, despite the frequence with which the skin comes into contact with tuberculous material, tuberculosis of the skin is rare; and, when it is verified, it tends to remain benign and localised.

Infection by mucous membranes. The *ocular* mucous membrane offers a very easy channel of penetration to tuberculous material. The instillation of a drop of virulent culture into the eye of a guinea-pig causes the development of a typical glandular tuberculosis which in four or five weeks extends to the glands of the hilus of the liver, the mesenteric glands, the spleen and the lung, without causing the slightest lesion in the eyeball and its surroundings.

The healthy *nasal* mucous membrane, despite the enormous quantity of dust of all kinds which it accumulates, does not permit the passage of the tubercle bacillus. This is because these dusts, microbes, etc., generally exercise a positive chemiotaxis upon leucocytes. The leucocytes pass out from the capillaries and submucous lymphatic spaces and englobe the bacilli; but then they are immobilized by the mucilaginous secretion of the muciparous glands, are unable to re-cross the mucous membrane and re-enter the circulation, and are expelled with the mucous discharge. As a matter of fact, bacilli are frequently found in the nasal cavity; but the cases of primary infection of this region are rare.

Bucco-pharyngeal mucous membrane.—Tonsils. Leucocytes which have escaped by diapedesis from the submucous vessels into the bucco-pharyngeal cavity are borne into the digestive tube with the saliva by the movements of deglutition, so that they do not re-enter the circulation with the bacilli they have englobed.

The *tonsils*, on account of their situation at the entrance of the digestive and respiratory apparatus, constitute a most important system of defence against microbial infections in general. The bacilli are very often destroyed by the lymphoid cells, swallowed or expelled by coughing; but often some migratory phagocytes bear them into the lymphatic circulation, and, in the case of a grave infection, there may be characteristic swelling of the retro-pharyngeal, subparotid, and cervical lymphatic glands as a result.

Genito-Urinary mucous membranes. In this situation the infection is most frequently of hæmotogenous origin; but it may occur directly through the vulvar, vaginal, urethral, or visceral mucous membranes by sexual intercourse or by the introduction of infected objects.

Infection by the respiratory passages. In Calmette's view, the old supposition that the tubercle bacillus penetrates the organism habitually or solely by the respiratory passages has now lost its weight. The more perfect knowledge which we now have of the diverse processes of the tubercular infections, and the certainty we have acquired that the bacillary infection remains *occult*—often for a long time and sometimes indefinitely—in the lymphatic glandular system before causing the formation of tubercles capable, as they develope and finally caseate, of releasing bacilli into the lymphatic or sanguineous circulation, enables us to modify the old view.

Mechanism of primary tubercular infection of the respiratory passages. This may be ærogenous or, more frequently, take place by the blood stream from the arrest, in the intra-alveolar or peri-bronchial capillaries, of some leucocytes containing bacilli recently introduced into the organism or proceeding from some centre of latent infection of varying age.

In an ærogenous fnfection, the bacilli which have penetrated an aveolus there cause a flow of leucocytes, then a true desquamation of the epithelial cells of the wall, and the whole forms, in the centre of the nodule, an accumulation which becomes organised in the form of a tubercular follicle, which then caseates and discharges caseous material into the neighbouring alveoli. *The evolution of this primarily alveolar lesion, when experimentally produced, is always rapid.* But if the infection is slight, the englobed bacilli re-enter the lymphatic circulation with the leucocytes, and the initial lesions occur at the periphery of the lobule or in the peribronchial lymphatic glands.

A *discrete* ærogenous infection, therefore, may not provoke any intra-alveolar lesions. (It is stated in a foot-note that examples of this are not infrequently found in cattle. Small tuberculous nodules in the bronchial glands, while the lungs are healthy, are not rare in bullocks and bulls, but are less common in cows. Bougert's view is that, in ærogenous infection, the bacilli which have reached the lung are englobed by leucocytes and carried to the peribronchial lymphatic glands, where the primary lesion occurs. From this the bacilli may again escape by the blood stream and infect the lung.)

Experimental pulmonary infeetion with bacilli or with products rich in dried bacilli. Villemin, in 1869, first demonstrated this possibility by means of experiments upon rabbits. Calmette gives a list of some other workers who, while not denying that such infection can take place, regard it as exceptional.

Experimental pulmonary infection with fresh bacilli or tuberculous products in a state of moist powder. All authorities agree that this method of transmission is possible by experiment. But the matter is quite different when we consider the possibility of a natural infection by this channel.

Condltions and retative frequenee of primary infection of the lung by inhaled air. Various circumstances are opposed to the possibility of such an infection. Among them are the large filtering surfaces of the respiratory passages, the length of the trachea and bronchi with their lining of vibratile cilia, the reflex irritability which causes sneezing and the expulsion of offensive particles, and, finally, the presence upon all the surfaces of the respiratory passages of glands secreting mucus which impedes the re-entrance of extravasated leucocytes into the lymphatic circulation. In the case of heavy dust, penetration is more easy; but tubercle bacilli within minute particles cannot easily avoid these naiural obstacles. Calmette, therefore, while acknowledging the possibility of natural infection of the lung by means of inhaled air, believes that it is much more difficult than is believed, or than would appear from experiments.

Infection by the intestinal tract—Mechanism of the intestinal absorption of the bacilli, and their migration in the organism. The stratified epithelium of the œsophagus and the thick layer of cylindrical, prismatic, or pyramidal cells of the stomach, and the numerous glands which discharge their secretions at the surfaces of these organs, do not *normally* permit leucocytary migration across their walls. On the other hand, processes of absorption go on with increasing intensity from the duodenum to the extremity of the small intestine. Microbes and some mineral particles in fine suspension are constantly drawn from the interior of the intestine towards the chyle ducts. This is accomplished by means of migratory cells; and the process is especially well marked in Peyer's patches. The bacilli are borne by migratory leucocytes into the chyle ducts, and follow the course of the lymph. Multiplication of the bacilli may cause the death of the leucocytes and the formation of tubercles by endothelial reaction along the course of the lymphatics. But if the bacilli are few or not very virulent, the leucocytes which have englobed them may not die, but preserve their motility and finally become arrested and die far away from the original point of entry of the bacilli. Here a capillary embolus is formed, from which a tuberculous process originates; and the organ which is anatomically most exposed

to such an infection is the lung. The apparently primary pulmonary lesion, then, is usually merely the manifestation of an infection of intestinal origin.

Experimental demonstration of the passage of bacilli across the healthy intestinal mucous membrane, and the course they follow to infect the lung and other organs. Chauveau first made this demonstration, and his results have been confirmed by numerous other workers. The experiments of Calmette and Guèrin, confirmed by Herman, show that the best method of obtaining a result is to give the virus mixed with food. Destroying their animals (guinea-pigs, goats, and cattle) at various periods after the ingestion of the material, they were able to follow the course of the bacilli. In sucking ani- the mesenteric glands were often the first to be infected by bacilli which had crossed the mucous membrane of the intestine without injuring it; for the lymphatic glands in young animals form a perfect filter. In older animals, in which the glandular structure is looser and more permeable, the bacilli pass the glands and then, englobed by leucocytes, gain the lung by way of the thoracic duct and the right side of the heart. There, arrested by the capillaries, they form foci of tuberculous infection.

Calmette, then, considers that in tuberculosis, whatever the original point of entry of the bacilli may be, invasion of the lung is always possible, and that the disease, in man and all susceptible animals, is almost always an infection primarily lymphatic and then sanguineous, which has absorption of the bacilli, by means of the digestive tract as its origin. —(*La Clinica Veterinaria*).

W. R. C.

Observations on the Methods of using the Agglutination Test in the Diagnosis of Disease in Bovines caused by the Bacillus of Contagious Abortion.

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Materials required on which to found a Diagnosis of Contagious Abortion.

The materials which may be examined are :—

(1) Vaginal or Uterine Exudate after Parturition.
(2) Fœtus or Fœtal membranes.
(3) Blood serum.
(4) Milk.

In animals which have recently aborted (1) and (2) are applicable, but in animals from which these were not secured, or in others in which it is desirable to diagnose infection in the absence of abortion, or at a time remote from the act of abortion, the most commonly used material is (3) Serum. This is of especial value because of its being easily obtained from cows at all stages of the disease from shortly after infection onwards; also from male animals, proving that they are susceptible to infection; and from laboratory animals, such as guinea-pigs. The drawback is the difficulty of obtaining the serum from a whole herd in the country, where dairymen would have to collect the samples.

It was because of this difficulty that investigations have been made as to the possible use of (4) Milk. As far as I have been able to ascertain, this material, on account of its physical properties, has not been used to any extent for the agglutination test. In some respects milk itself is an unsatisfactory material, and for that reason whey, prepared by the artificial clotting of milk, has been used. Although these investigations are incomplete, they furnish evidence strongly suggesting that it will be found satisfactory for diagnosis. Should this be so, milk, from its ease of collection, would be the ideal material for examination in the case of lactating animals.

When *whey* has been nsed the agglutination test alone has been applied to it.

When using exudate (vaginal discharge containing uterine exudate), the means available in the hands of the bacteriologist are :—

(1) *Microscopical examination.*—To a person who is in the habit of frequently examining specimens containing the *bacillus abortus* the diagnosis presents no great difficulties, especially if the organisms are plentiful and typically arranged. On the other hand there are met with in vaginal or uterine material bacteria which simulate more or less the *B. abortus*, and here the other tests aid to confirm the diagnosis.

2. *Cultures.*—For these to be satisfactory, the material should be as free as possible from contamination by other organisms. In Australia a cow is frequently at grass when abortion takes places, and may have aborted some days before the stockman sees her. The discharge in such cases is sure to be badly contaminated.

Also, the discharge should obviously not contain any antiseptic. It sometimes happpens that one is called upon to examine material from a cow which has been syringed out with lysol, the specimen smelling strongly of the antiseptic. For these reasons this method is of very limited application.

3. *Inoculation of Animals.*—The remarks made about contamination and antiseptics under the last heading apply equally here. Nevertheless, this method of diagnosis has been used here with success, guinea-pigs being used. Owing to the length of time before marked lesions develop one resorts to the agglutination test of the blood serum of the guinea-pig to determine whether infection by the specific organism has taken place.

4. *Agglutination test.*—This has proved valuable in diagnosing a sample of exudate, in which the microscopical findings were doubtful, and where, on account of great contamination, cultures were not obtained.

It has been found very delicate, as little as 0.0025 c.c. of exudate causing agglutination. From one of these positive cases the blood serum, secured 16 days later than the exudate, and 17 days after abortion, gave an exactly similar agglutinating titre to the exudate.

Further, exudate may be kept until it is fairly swarming with bacteria, and yet show little loss of agglutinant action. Also exudate diluted with carbolised saline (10 % of exudate in saline containing 0.5 % of carbolic acid) shows little loss of agglutinating bodies.

Exudate from a healthy cow which calved at the Institute was tested, and even in an amount of 0.25 c.c., failed to give any agglutination.

5. *Complement Fixation test.*—No opportunity has presented itself of applying this test to Exudate, but, judging from the results with the agglutination test on this material, there seems to be no reason why it should not be of use for diagnostic purposes.

[An opportunity has since presented itself of testing, by the Complement Fixation method, a sample of vaginal exudate from a cow which had recently aborted. The result was positive.]

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Technique Employed.

In the following pages details of the technique employed in the use of all the materials examined are given with a view to a standardisation of the test in the hands of different workers, so that the interpretation and comparison of results may be possible and accurate.

a.—The use of whey and the value of the method.

That the specific agglutinins of *Bacillus abortus* may occur in milk has been mentioned by M'Fadyean and Stockman, (1) in the Appendix to Part I. of the Departmental Committee's Report, page 28, where they say: "We also found that the milk of an animal which had aborted possessed agglutinating properties up to 1 in 25, but, owing to the opacity caused by the addition of milk to a culture, milk is unsuitable for testing purposes." Whether this product has been used at all in diagnosis I am not aware.

It is obvious that if milk, or milk products, could be used it would be advantageous, owing to the ease of securing specimens: but, as milk, even diluted, is unsatisfactory on account of its physical properties, experiments were made with whey. The whey was obtained by clotting milk with Lactic Acid, the technique being as follows:—

To 9 c.c. of milk, 1 c.c. of a 10 per cent. aqueous solution of lactic acid is added and mixed. The coagulated milk is then filtered through either cotton-wool and filter-paper, or filter-paper alone, the latter method being usually applied.

The whey is then diluted, one part to nine parts of carbolised saline (Acid. Carbol. liq. 0.5, Sod. chlor. 0.85, water 100), to form the basal dilution 1 in 10, and incubated over-night. Incubation and subsequent filtration are found necessary, otherwise there may be a deposit of albuminous material, which, though unlike the typical deposit of agglutinated organisms, is not desirable, since it may lead to confusion in reading the results.

With the diluted, incubated, and filtered whey, four tubes, each receiving 0.5 c.c. of standard bacterial emulsion, are put up, containing the following amounts of the basal dilution of whey (1 in 10).

	A.	B.	C.	D.
	1.0	0.2	0.1	0.05 c.c.
(representing	0.1	0.02	0.01	0.005 c.c. of pure whey).

As a control, 1 c.c. of diluted whey is put in a tube without any emulsion.

Carbolised saline is then added till the amount of liquid in each tube is approximately 1.5 c.c.

Thus the series of tubes contain:—

	A.	B.	C.	D.
Whey	0.1	0.02	0.01	0.005 c.c.
Emulsion	0.5	0.5	0.5	0.5 c.c.
Saline	0.9	0.98	0.99	0.995 c.c.

The tubes are then shaken and put in the incubator till next day, when the results are read. Further incubation shows little alteration, a tube showing "partial" agglutination—*i.e.*, small deposit, with no "clearing" of the supernatant fluid at the end 18 to 24 hours, may be complete at the end of 36 to 48 hours.

Whey, from milk which had been kept 20 days at room temperature, and clotted naturally, has also been tested, when it was found that this bacterially-produced whey exhibited the same titre as the whole milk.

A large number of experiments with whey have been performed, but as yet no conclusion has been come to as regards the limiting titres upon which a diagnosis may be made. It has been found that the agglutinins in whey increase and decrease in much the same manner as they do in blood serum. The work to date has been chiefly among cows on a property where the disease has been in existence for a number of years, but where the abortions, since the investigations commenced, have been very few—not sufficient to warrant a definite opinion as to the comparative value of whey versus serum. Sufficient has been done, however, to warrant investigation of the value of whey as a material for diagnosis by other workers.

b.—Collection of Serum from Cattle and Guinea-pigs. Occurrence of the Agglutinins in the Blood of Steers.

Cattle.—Undoubtedly the most satisfactory method of obtaining serum in large quantities is by bleeding from the jugular vein, but as this method takes some time, and often necessitates the casting of the animal, another and simpler method is preferable where only small quantities of blood, sufficient for diagnostic purposes, are required.

It has been found that such may be best obtained from the small artery which runs with the vein extending along the centre of the dorsum of the ear. This vein is the most prominent and is easily found. The hair is clipped off, and an incision is made across the vein and the artery at a point about mid-way between the tip and the base of the ear. The artery may not be cut at the first incision, as it usually lies underneath the vein, and a second rather free incision may be necessary. From this the blood spurts or drips freely, and 5 to 10 c.c. can be collected in a test-tube. The blood is allowed to clot, the clot loosened from the sides of the tube for about two-thirds of its attachment, and the tube inverted in a conical urine test-glass. After allowing this to stand for some hours, the serum may be collected free from corpuscles.

Guinea-pigs.—The following method has been found satisfactory for obtaining small quantities of serum for diagnostic purposes:—

Centrifuge tubes are put up, containing 2 c.c. of citrated carbol saline (Sod. chlor. 0.85, Sod. cit. 1, Ac. Carb. liq. 0.5, water 100). The margin of the ear of the guinea-pig is then incised with the scissors and held dependant. There is a small artery in this region from which, if it has been cut, the blood drips freely. Six drops of blood are collected in the prepared tubes. If we assume that six drops of blood are equal to 0.3 c.c., then we should have about 0.2 c.c. of serum in each tube, or a dilution of 1 in 10.

The tubes are shaken, centrifugalised, and the supernatant fluid pipetted off and tested in various quantities. Though not quite accurate, this method is sufficiently so for determining whether the animal is harbouring the bacilli, as, for example, those animals inoculated with vaginal exudate or milk from suspected cows. Healthy, non-inoculated guinea-pigs have invariably given a negative reaction, even with 0.1 c.c. of pure serum (*i.e.*, 1 c.c. of the citrated saline mixture), whereas some of our reacting guinea-pigs have given an agglutinating titre of 0.005 c.c., and in one case of 0.0005 c.c.

Examination of the Blood of Steers.

Because of the large number of cows which give a positive agglutination reaction, it is important to determine whether agglutination of the contagious Abortion bacillus is brought about by normal ox serum, and, if at all, to what extent. With a view to obtaining information on this point, experiments have been conducted with the serum of male animals never used for breeding.

The following experiments have been made with the serum of steers. The animals were for human consumption, and the blood was taken, immediately upon slaughter at the abattoirs, into a bottle containing a small quantity of strong (20%) citrate solution. The serum was obtained by centrifugalising and tested as follows:—

Basal dilutions were made containing 1 of serum to 9

of carbolised saline; the amount of standardised emulsion used in each tube was 0.5 c.c. Results:

c.c. pure serum	0.1	0.06	0.04	0.02	0.01	0.005
Steer 1	—	—	—	—	—	—
2	—	—	—	—	—	—
3	—	—	—	—	-	—
4	—	—	—	—	—	—
5	++			++	++	+
6	—	—	—	—	—	—
7	+	S	—	—	—	—
8	—	—	—	—	—	—
10	S	S	—	—	—	—

++ Agglutination and clearing. + Agglutination.
S Slight agglutination. — No agglutination.

It will be seen that, with the exception of Steer No. 5, no animal gave a positive reaction with less than 0.1 c.c. of pure serum, and only one a definite agglutination with that amount. With regard to the "S" readings, as mentioned elsewhere, we do not count these as positives, as the amount of agglutination is extremely small—only perceptible on very careful naked eye examination.

The serum of the positive steer (5) was also tested by the complement fixation method, and again gave a positive reaction.

(c) *Standardisation of the Bacterial Emulsion.*

In the description of the technique adopted by other workers there is a remarkable absence of detail as to the concentration of the bacterial emulsion.

Although Mohler and Traum (2) use a method of standardising bacterial emulsion ("agglutinating fluid"), they do so by comparing it with "the old titred agglutinating fluid," but how this "old agglutinating fluid" itself was standardised they do not say, nor do they indicate what it was like in appearance.

M'Fadyean and Stockman (3) prepare "an emulsion of greater turbidity than is ultimately required," and dilute it "until when viewed in one of the small tubes employed for the tests it is faintly hazy in appearance."

In this laboratory a method based upon comparison of the emulsion to be employed with a suspension of Barium sulphate has been used, the idea being suggested by the "Nephelometer" of McFarland (4).

For the test the following solutions are made:—A 1% solution of Barium chloride in distilled water, and a 1% solution of Sulphuric acid in water. Three cubic centimetres of Barium solution is then mixed with 97 cubic centimetres of the acid solution, shaken, and allowed to stand, to come to a state of chemical equilibrium.

The *B. abortus* is sown on agar in Roux flasks and incubated for two or three days, the water of condensation being run over the surface daily so as to get a good growth over the whole surface. Twenty cubic centimetres of carbolised saline (Ac. Carb. liq. 0.5, Sod. chlor. 0.85, water 100) is then added to the flasks and the growth washed off, shaken thoroughly, and passed twice through filter-paper. Dilutions of this suspension, or "emulsion," as it is generally called, are then made with carbolised saline as follows:—1 c.c. of emulsion and 1 c.c. of carbolised solution; 1 c.c. of emulsion and 2 c.c. of carbolised saline; and so on up to 1 c.c. of emulsion and 10 c.c. of carbol saline. These suspensions are the fluids to be compared with the Barium sulphate mixture.

To compare, the Barium sulphate mixture is thoroughly shaken, and a small tube of about 1 cm. calibre filled with the fluid, the fluids to be tested being placed in similarly sized tubes and comparisons made over printed paper. This Barium suspension is our standard of opacity for emulsion (Standard X).

Supposing the tube which approximates the opacity of the Barium mixture is that tube which contains 1 c.c. of thick emulsion and 6 c.c. of carbolised saline, then this tube is of the proper standard, and is called "Standard X." The whole of the emulsion may then be diluted down with carbolised saline to the proper strength, or kept as thick emulsion, the standard being now known. In the case instanced, the thick emulsion may be termed "7 X," thereby denoting that it requires diluting to seven times its volume—*i.e.*, adding six times its volume of carbolised saline, to prepare a standardised emulsion "X."

In our tests, in which we make the total volume of fluid in the tube up to 1.5 c.c., we use 0.5 c.c. of this standard emulsion "X" in each tube.

References.

1. M'Fadyean and Stockman (1909). Report of Departmental Committee (Board of Agriculture, Gt. Britain), on Epizootic Abortion, Part I.
2. Mohler and Traum (1913). Annual Report, Bureau of Animal Industry, Dept. of Agriculture, U.S.A. 1911, pp. 147-183.
3. M'Fadyean and Stockman (1912). Journal of Comparative Pathology and Therapeutics, Vol. XXV., 1912, pp. 22-29.
4. McFarland, Journal American Medical Association, Vol. 49, p. 1176. Extracted in Bulletin de L'Institut Pasteur, Vol. 6, 1908, p. 123.
5. Hewlett (1914). Manual of Bacteriology, 5th Edition, p. 188.

To be concluded.

ON THE USE OF CERTAIN ANTISEPTIC SUBSTANCES IN THE TREATMENT INFECTED WOUNDS.*

By H. D. Dakin, D.Sc., F.I.C., The Herter Laboratory, New York.

[A previous extract on this subject appeared in our issue of August 21st. As some members of the veterinary profession are strongly of opinion that this antiseptic will be of material assistance to the veterinary profession, we reprint the essential portion of a further paper which appears in the *Brit: Med: Journal* of August 28th].

"The germicidal activity of all known antiseptics is greatly reduced by the presence of blood serum or similar substances, and in some cases this reduction is so great that the compound loses all practical antiseptic value.

The following table contains results which illustrate this enormous reduction in germicidal action by blood serum in the case of several common antiseptics. I am greatly indebted to my colleage, Dr. Maurice Daufresne, for all the bacteriological results referred to in this communication.

The figures indicate the concentration of antiseptic necessary to sterilize one drop of a fresh culture of *Staphylococcus aureus* in a total volume of 5 c.cm. acting for two hours. + indicates growth; — indicates complete sterilization.

But in choosing a suitable antiseptic many other factors than germicidal action need to be considered. Mercuric chloride, which among the substances referred to in the table shows the highest germicidal action, is probably the least useful and most objectionable as an antiseptic for the treatment of infected wounds. It may be of use to consider some of the limitations of

* The work described in this communication was carried out it laboratories at Compiegne supported by the Rockefeller Institute for Medical Research attached to Hospital 21 of the French army. For cordial co-operation in the preparation of a large number of chloramines and other substances, upon which a detailed report will be published later, I am indebted to my former teacher, Professor J. B. Cohen, F.R.S., of the University of Leeds, and to Dr. J. Kenyon, who was appointed by the British Medical Research Committee.

the commonly used substances referred to in the table.

Antiseptic.	Without Blood Serum.	With Blood Serum.
Phenol	1 : 250 –	1 : 50 –
	1 : 500 +	1 : 100 +
Salicylic Acid	1 : 2,500 –	1 : 100 –
	1 : 5,000 +	1 : 250 +
Hydrogen peroxide	1 : 3,500 –	1 : 1,700 –
	1 : 8,000 +	1 : 2,000 +
Iodine	1 : 100,000 –	1 : 1,000 –
	1 : 1,000,000 +	1 : 2,500 +
Mercurial chloride	1 : 5,000,000 –	1 : 25,000 –
	1 : 10,000,000 +	1 : 50,000 +
Silver nitrate	1 : 1,000,000 –	1 : 10,000 –
	1 : 10,000,000 +	1 : 25,000 +
Sodium hypochlorite	1 : 500,000 –	1 : 1,500 –
	1 : 1,000,000 +	1 : 2,000 +
Benzene sodium sulphochloramide	1 : 500,000 –	1 : 1,000 –
	1 : 1,000,000 +	1 : 2,000 +
Paratoluene sodium sulphochloramide	1 : 750,000 –	1 : 2,000 –
	1 : 1,500,000 +	1 : 3,000 +
Acetychloramino-dichlorbenzene	1 : 500,000 –	1 : 2,500 –
	1 : 1,000,000 +	1 : 5,000 +

Phenol is characterised by very low germicidal power, especially when acting in the presence of serum. When used in sufficiently high concentration for germicidal efficiency it is decidedly destructive of healthy tissue.

Hydrogen peroxide gives encouraging results when tested against bacteria in the test tube, but when used on wounds the substance has little germicidal action, for it is decomposed with the greatest ease by the enzyme catalase present in all tissues and in the blood cells. Hence its action can only be exerted during a trifling interval of time. The mechanical detergent action connected with the rapid disengagement of oxygen gas on infected surfaces is probably of greater value than any antiseptic action exerted by the hydrogen peroxide.

An interesting experiment related to me by Professor E. K. Dunham may be quoted here. A rabbit which had received an intravenous injection of the Welch bacillus (*B. aërogenes capsulatus* or *B. perfringens*) was killed, and the infected liver was removed and carefully sectioned. It was found that cubes of the infected liver only 1 mm. in size could be immersed in and incubated with hydrogen peroxide of moderate concentration without destruction of the micro-organisms.

Hydrogen peroxide, as regards its antiseptic action, must be regarded as of slight value, even against anaërobic organisms.

Mercuric chloride readily loses most of its antiseptic action in presence of many tissue constituents, and, as is well known, is irritating even in dilute solution. It is useless for the sterilization of pus when employed at any reasonable concentration.

Silver nitrate is of greater value than mercuric chloride, but when used in sufficiently high concentration is irritating. Many tissue constituents inhibit its action markedly. The photo-sensitiveness of the silver compounds formed is objectionable.

Iodine, which has proved so valuable for the disinfection of skin, has given much less satisfactory results when used for deep wounds owing to protein coagulation and irritation of the tissues. The penetrating power of iodine is slight, and wounds which have been freely treated with it are apt to cicatrize more slowly than others.

Sodium hypochlorite has high germicidal action, and has many other desirable properties. But sodium hypochlorite as ordinarily prepared is of extremely variable composition, contains free alkali and sometimes free chlorine, and is consequently irritating when applied to wounds. By a simple process, which will now be described, it has been possible to render the hypochlorites much less irritating while retainieg their antiseptic action unchanged.

Principles involved in the preparation of the Hypochlorite Solution.

Solutions of sodium hypochlorite always contain free alkali even when prepared with the greatest care. A so-called "neutral" solution of sodium hypochlorite has an alkaline reaction. This is due not only to free alkali which may remain from the process of preparation, but also to the fact that the hypochlorite in solution undergoes hydrolytic dissociation giving free sodium hydroxide and hypochlorous acid.

$$NaClO + H_2O = NaOH + HClO$$

The extent of this dissociation has been measured by Duyk and quantitatively it is very considerable. The irritating action of ordinary hypochlorites is largely due to this formation of free alkali. The extent of this hydrolytic dissociation increases with dilution, so that practically hypochlorites cannot be effectively rendered non-irritating by simply reducing the concentration, for a point is soon reached at which germicidal action is impaired while the irritating properties of the solution persist. In addition to the above sources of free alkali, it must not be forgotten that alkali may be liberated by the action of sodium hypochlorite on proteins, a reaction in which the chlorine of the hypochlorite is attached to nitrogen in the proteins, as will be shown later.

Now it is well known that certain fluids, such as blood and some other body fluids, also certain artificial salt solutions containing mixture of salts of ploybasic acids—for example, phosphoric acid—are able to retain their essential neutrality even after the addition of limited quantities of acid or alkali. This is due to the fact that the addition of acid or alkali simply changes the relative proportion of two or more salts of the polybasic acid present in the solution.

Starting with this idea, and employing the feeble polybasic acid, boric acid, it has been possible to prepare a simple hypochlorite mixture which maintains approximate neutrality under all conditions, is practically non-irritating, and which, when properly applied has given most encouraging results in the antiseptic treatment of wounds. It must be understood that the insignificant antiseptic action of boric acid has nothing to do with the employment of this acid; nor is the boric acid employed for the purpose of liberating hypochlorous acid, as in Lumière's or Lorrain Smith's preparations.

The principle of the preparation is as follows: Chloride of lime (bleaching powder) is decomposed with a solution of sodium carbonate and the filtered solution containing sodium hypochlorite together with a slight excess of alkali is mixed with boric acid in such quantity that the solution is acid to phenolphthalein suspended in water, but still alkaline to litmus. The resultant solution contains a balanced mixture of hypochlorite and polyborates of sodium with small amounts of free hypochlorous and boric acids. Thus the irritating action of free caustic alkali is avoided, for even if momentarily formed it would be at once neutralised by the boric acid or acid borates present in the solution.

Preparation of Solutions.

"The preparation of a solution of suitable concentration for direct application, containing 0.5 to 0.6 per cent. of sodium hypochlorite, may be carried out very simply as follows:—

One hundred and forty grams of *dry* sodium carbonate (Na_2CO_3), or 400 grams of the crystallized salt (washing soda), is dissolved in 10 litres of tap water, and 200 grams of chloride of lime (chlorinated lime) of good quality is added. The mixture is well shaken, and, after

half an hour the clear liquid is siphoned off from the precipitate of calcium carbonate and filtered through a plug of cotton; 40 grams of boric acid are added to the clear filtrate, and the resulting solution is ready for use. A slight additional precipitate of calcium salts may slowly occur, but it is of no significance. The solution should not be kept longer than one week. *The boric acid must not be added to the mixture before filtering, but afterwards.*

A stronger solution may be prepared by decomposing chloride of lime with sodium carbonate in the proportion of 150 grams of the former to 105 grams of the latter dissolved in a litre of water. The mixture is filtered and a measured portion of it (20 c.cm.) is rapidly titrated with a boric acid solution of known strength (31 grams per litre), using phenolphthalein suspended in water as indicator, in order to determine the amount of solid boric acid to be added to the rest of the filtrate. An excess of boric acid should be avoided, so that it is best to add slightly less than the calculated amount. An ordinary alcoholic solution of phenolphthalein cannot be used as indicator, as the alcohol is at once attacked.

The concentrated solution thus prepared contains about 4 per cent. of sodium hypochlorite, and should be mixed with six parts of water before use. It can be kept for a month without serious decomposition. Such a solution can easily be made at a negligible cost by any competent chemist, and I hope it may be so made generally.

APPLICATION AND RESULTS.

"To obtain the best results it is essential to commence the antiseptic treatment of the wound at the earliest moment possible, and to bring fresh quantities of the antiseptic solution in contact with all parts of the wound as frequently as possible for a considerable period of time. This is naturally a difficult problem, requiring different methods for various types of wound. To give some idea of the quantities of solution employed it may be mentioned that 5 to 10 c.cm. may be introduced every two hours by means of rubber tubes into small wounds, using a pipette or syringe, while for the irrigation of wounds accompanied by much destruction of tissue, as much as one, or even two, litres may be employed. The dilute solution, prepared as described, may be used in large quantities for the continued irrigation or instillation of wounds for more than a week without producing visible irritation. It is extremely rare for slight irritation of the skin to occur, and this may be guarded against by the application of vaseline to the skin adjacent to the wound. As a wet dressing the solution may be used almost indefinitely. A few comparative tests on similar surface wounds do not indicate that cicatrization is delayed, even by its continued use.

The solution has the valuable property of assisting in the rapid dissolution of necrosed tissue, this being doubtless due to the ability of hypochlorites to attack the (NH) groups present in proteins with formation of soluble products. It has a certain hæmo static action as well, but is actively hæmolytic and should not be injected intravenously.

Methylene Blue for Contagious Abortion.

The following is quoted by *Farm and Home*:—

A circular letter has been issued by Professor Rich, of the Vermont Experiment Station, concerning the method of controlling contagious abortion by the use of medicinal methylene blue which he originated and has had good success with. He says:—"My treatment for infectious abortion in cows as administered at present consists in giving each cow half an ounce of medicinal methylene blue, on silage, once a day for four or five weeks. After calving, the treatment is resumed for a few days; and within a few hours after freshening, preferably immediately after expulsion of the afterbirth, the cow's uterus is washed out with a methylene blue solution, consisting of half an ounce of the blue and an ounce of table salt to the gallon of boiling water. The solution is cooled to about 105° F., and strict aseptic precautions are observed in its introduction into the cow's uterus. The stables are thoroughly cleaned and disinfected and the disinfection is repeated after each occurrence of abortion therein. The calving pen is cleaned and sprayed with mercuric chloride solution, each time after occupation; and on the return of each fresh cow to her stanchion, the platform and trench behind her are sprinkled daily with 1 to 1000 mercuric chloride solution for at least ten days. The afterbirth is burned or deeply buried, and the calf and soiled hind parts of the cow are carefully sponged with warm 1 per cent. lysol solution. The sheath of the bull is washed with a 1 per cent. lysol solution, and either this or the above described methylene blue solution is injected into it."

Hypochlorous Acid as an Antiseptic.

Under the heading "A New Antiseptic," in the daily papers recently it was announced that a communication had been made to the Academy of Science in Paris referring to the discovery of a new antiseptic for the treatment of wounds. Some accounts stated that the new antiseptic was chlorinated lime (calcium hypochlorite), to which boric acid had been added, and subsequently chalk to neutralise the acidity of the mixture. Later it was stated that the new antiseptic was prepared by adding to a solution of sodium hypochlorite boric acid until the mixture was neutral. In both cases it seems fairly obvious that the net result would be a solution of hypochlorous acid, a well-known and powerful antiseptic, probably more efficacious than chlorine itself.

But the claims to novelty for this antiseptic are ill-founded. It is a good many years since we announced from *The Lancet* laboratory that the activity of ordinary bleaching powder was greatly increased by passing through it carbonic acid gas which liberates hypochlorous acid. Any other acid—*e.g.*, boric acid—will do the same thing. In 1894 we investigated the Hermite process for the sterilisation of sewage, which consisted in passing a current of electricity through sea-water, which was demonstrated to produce hypochlorous acid. The germicidal power of this electrolytic fluid was shown to be more than equal to corrosive sublimate; it was found to possess the advantage that it did not become inert by forming insoluble compounds with albumins, while it could be very cheaply produced. We pointed out at the same time that a practically identical fluid, except for an excess of common salt, could be produced by passing carbonic acid gas through a solution of bleaching powder. Later it was found that by adding bicarbonate of soda in excess to bleaching powder solution a fluid was obtained containing free hypochlorous acid, although the product possessed acid-neutralising properties due to the excess of bicarbonate of soda present. —*The Lancet.*

ARMY VETERINARY SERVICE

Extract from *London Gazette*,

WAR OFFICE, WHITEHALL, Sept. 17.

REGULAR FORCES. ARMY VETERINARY CORPS.

Lt. P. S. Sparling, from S.R., to be Lieut.; Temp. Lt. S. L. Symonds to be temp. Capt. Dated Sept. 18.

To be temp. Lieuts:—

J. H. Crawford. Dated Aug. 25.

A. Hart. Dated Sept. 3.

V. R. de Boissiere. Dated Sept. 6.

Sept. 18.
Temp. Lieut. E. A. Wilshaw relinquishes his commn. on termination of engagement. Dated Sept. 7.
To be temp. Lieut.:—J. C. Collings. Dated Sept. 7.
Sept. 20.
Lt. H. Chown, from S.R., to be Lieut. Dated Sept. 21.
Temp. Lt. W. Scott to be temp. Capt. Dated Sept. 6.
Sept. 21.
Temp. Capt. F. C. Gavin to be temp. major, while holding appmt. of Asst. Dir. Vet. Serv. Dated Aug. 11.
Temp. Lieut. L. S. Sedgwick relinquishes his commn. on ceasing to be employed. Dated Sept. 4.
Sept. 22.
To be temp. Lieut.:—W. F. Wright. Dated Sept. 9.

The following casualties in the Expeditionary Force, which occurred during April and May, are reported:—

WOUNDED—Sgt. H. Drury, 19; Ptes. H. Earle, 91; R. Howards, 2027; H. Newstead, 1428; C. Stansfield, 3891; O. Stroud, 1683; Shoesmith A. Weston, 2006.

Personal.

Capt. F. J. TAYLOR, A.V.C. (T.F.), is now in Campbell Hospital, 10 Cambridge Square, Hyde Park. He was invalided from Egypt, owing to a horse accident, and in consequence has undergone an operation, which has been successfully performed by Col. Battle.

Capt. Taylor has had a varied experience. On mobilization he was serving with 5th London R.F.A. on Salisbury Plain. He was then transferred to Headquarters Staff, 2nd London Division, Chelsea Barracks, and moved with the Division to St. Albans, where he took command of the Divisional Veterinary Hospital, establishing and equipping it, and obtaining recruits for the section. Next he was transferred as O.C., "C" Mobile Veterinary Section, 2nd Mounted Division, which was then in Norfolk and under orders for France, but, owing to the threatened air raid, these orders were cancelled, and at the end of March they proceeded to Egypt, and served as a Cavalry division in Cairo, Alexandria, and Suez Canal. He says: "We saw quite a lot of the Turks in their several attempts to attack the Canal defences. I was fortunately attached to the London Mounted Brigade, comprising Middlesex, City of London, and 3rd County of London Yeomanry—a splendid lot of men, who have given more than a good account of themselves in that hellish campaign on the Peninsula, and, although dismounted, have gloriously upheld the honour of the 4th Brigade. It is my only regret in life that I was prevented from being with them."

HARRISON—SMALL. At the Parish Church, Herne, Kent, on Monday, Sept. 20th, G. A. Harrison, M.R.C.V.S., son of the late Mr. Benjamin Harrison and Mrs. Harrison, Wemley Bank, Thornbury, Bradford, Yorks, to E. N. (Nellie) Small, of Harrogate.

The marriage of Capt. T. A. BLAKE, M.R.C.V.S., of the Dept. of Agric: New Zealand, was announced recently at Cairo.

TREATMENT OF NEMATODE DISEASES.

I was much interested in the article by Prof. Craig, "The use of Drugs in the Treatment of Disease caused by Nematode Worms," which was presented at the Tenth International Veterinary Congress, London, 1914, and published in your paper of August 21st. About 18 months ago I had a three-year-old colt, bred by myself, which was literally dying by being affected with worms. It was some time, and after a good many attempts, before I found them, little red things, about a ½-inch long; Sclerostoma Tetracantha, and also the longer ones, the Sclerostoma Armata.

At Veterinary meetings I used to suck everyone's brains as to what treatment to adopt, but without much success. I thought seriously of destroying the colt, as after being out at grass in a good field all May and June, 1914, he did not improve at all; but before doing so I decided to write to the Veterinary papers and ask if any Veterinary Surgeon could advise me on a successful treatment.

Mr. John Brown, of Invergordon, kindly replied, and suggested that I should try Atoxyl, and referred me to an article which I had not seen, on the results of cases treated with Atoxyl.

Accordingly, I took up the colt from off grass, and gave him two subcutaneous injections a day of Atoxyl. I regret I cannot remember the dose I started with, but doubled the dose every week up to the end of the fourth week.

I also gave 40 grains of Thymol three times a day in a pint of milk. At the end of a month the colt had improved out of all recognition.

On War being declared in August, 1914, I sent my colt to the Royal Veterinary College, Camden Town, where Prof. Wooldridge kindly continued the treatment for me, but continued the dose of Atoxyl as it was at the end of the fourth week.

The colt kept on improving, and after a month Prof. Wooldridge, after having several times searched for the worms without any success, sent the colt to my home, where he was turned out in different pastures.

When I saw the colt again in December, on my first leave home, he looked in excellent condition, and had filled out enormously. The colt kept in excellent condition and got quite fat, but he never grew after he was 2½ years old, and was only 15-1.

I sold him at Tattersall's last July, a four-year-old, unbroken, for fifty guineas. The treatment cost me about £12, but it was well worth it, both from a financial and an instructive point of view.

A doctor told me that in Egypt he had often given men half-drachm of Thymol, so perhaps our dose for horses is far too small. I might add that the price of Atoxyl is £1 an ounce, and Thymol 3/- an ounce.

GRAHAM REES-MOGG, F.R.C.V.S.

32nd Division, Codford,
21st Sept.

VALIDITY OF AGREEMENTS—A QUESTION.

Sir,—I should be glad to know if the usual agreement with a veterinary assistant (not to practise in a district for a fixed time) properly drawn up, signed, and stamped, is still considered legal. Possibiy some of your readers can tell.

I think it a question that concerns the whole profession.

Yours truly, PRO BONO PUBLICO.

In view of the need for husbanding the food supply of the country, the Board of Agriculture and Fisheries decided last August that the slaughter of pigs for the purpose merely of reducing the risk of the spread of swine fever should be resorted to as little as possible, and that the slaughter of breeding sows or partially matured animals purely as a matter of precaution should be avoided. The Board has therefore relied on isolation combined with the slaughter of all swine distinctly sick of Swine Fever at the time of diagnosis.

Meanwhile, investigations into the efficacy of the injection of Anti-Swine-Fever serum which were being carried out before the war began have been continued, and the results obtained, together with the evidence accumulated as to its use in other countries, show that if proper precautions are taken immunity from Swine Fever can be established by serum treatment.

The Board are now in a position to offer serum treatment of pigs free of cost, in the early stages of an outbreak of Swine Fever; and they wish to impress on all owners that to obtain the best results from this treatment notification of the suspected existence of Swine Fever on their premises should be made at the earliest possible date. Any delay in notifying not only renders the owner liable to prosecution for failing to comply with the provisions of Article 1 (1) of the Swine Fever Order of 1908, but also tends to increase his loss, owing to more pigs becoming affected before serum treatment is carried out.

Board of Agriculture and Fisheries,
4 Whitehall Place, London, S.W.
18th September, 1915.

DISEASES OF ANIMALS ACTS 1894 TO 1914, SUMMARY OF RETURNS.

Period.	Anthrax		Foot-and-Mouth Disease.		Glanders.†		Parasitic Mange. ‡		Sheep Scab.	Swine Fever.	
	Out-breaks (a)	Ani-mals.	Out-breaks (a)	Ani-mals.	Out-breaks (b)	Ani-mals.	Out-breaks (b)	Ani-mals.	(b)	Out-breaks (a)	Slaugh-tered. *
Gr. BRITAIN. Week ended September 18	3	3				1	15	28	1	43	99
Corresponding week in 1914 ...	10	12			1	1				103	470
Corresponding week in 1913 ...	12	14			3	3	17	25	1	46	543
Corresponding week in 1912 ...	6	8	1	26	1	1	22	36		28	472
Total for 38 weeks, 1915	436	497			36	66	‡620	‡1339	162	3136	13802
Corresponding period in 1914 ...	548	600	22	108	79	232	1526	2638	155	3063	30470
Corresponding period in 1913 ...	402	444			121	298	1976	3958	133	1836	24377
Corresponding period in 1912 ...	589	670	78	589	135	248	2403	5175	175	2318	30552

‡ The Parasitic Mange Order of 1911 was suspended from 6th August, 1914, to 27th March, 1915, inclusive.

(a) Confirmed. (b) Reported by Local Authorities. † Counties affected, animals attacked : Stafford 1.

Board of Agriculture and Fisheries, September 21, 1915 ‡ Figures for twenty-five weeks only.

IRELAND. Week ended Sept. 18	...	...	...	...	...	...	Outbreaks 1	2	5	25
Corresponding Week in 1914 ...	...	...	...	...	...	...	2	3	1	5
Corresponding Week in 1913 ...	...	...	...	...	...	...	...	7	...	...
Corresponding Week in 1912 ...	...	...	1	1	...	...	...	1	3	9
Total for 38 weeks, 1915 ...	1	1	...	...	1	3	57	307	191	1057
Corresponding period in 1914 ...	1	1	76	957	...	...	67	400	161	841
Corresponding period in 1913 ...	...	...	...	...	...	...	102	390	115	693
Corresponding period in 1912 ...	3	3	28	261	...	...	53	265	183	1508

Department of Agriculture and Technical Instruction for Ireland, (Veterinary Branch), Dublin, Sept. 20, 1915

NOTE.—The figures for the Current Year are approximate only. * As diseased or Exposed to Infection.

Veterinary Societies—Addresses.

BORDER COUNTIES V.M.S.
Pres: Mr. H. Barrow, M.R.C.V.S., Ireby, Carlisle
Hon. Sec: Mr. R. Craig Robinson, M.R.C.V.S., Carlisle
Meetings, Second Friday of Feb., June, and October

GLASGOW V.M.S.
Pres. Principal McCall.
Hon. Sec. Mr. J. D. Fulton, 83 Buccleuch Street, Glasgow

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Hon. Sec: Mr. B. Gorton, M.R.C.V.S. *Assist*. Mr. P. R. Turner

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Treas: Mr. J. B. Wolstenholme, F.R.C.V.S., Quay-street, Manchester

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Pres. Mr. S. H. Slocock, F.R.C.V.S., Montague Rd, Hounslow
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COLONIAL SOCIETIES (*continued next page*)

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V. Pres: Maj. A. P. Gribben, F.V.O., M.R.C.V.S.
Hon. Sec. & Treas: Mr. Max. Henry, M.R.C.V.S., B.V.SC. (SYD). 56 Bridge Street, Sydney

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ASSOCIATION MÉDÉCALE VÉTÉRINAIRE FRANÇAISE "LAVAL
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11 Anchor Terrace, Southwark Bridge, S.E.
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Hon. Sec. A. W. Noël Pillers, (F)
71 Smithdown Lane, Liverpool

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Pathological Sec: Mr. D. C. Matheson, F.R.C.V.S.
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Meetings, Third Friday, Feb., May, Aug. and Nov.

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Hon. Sec: Mr. J. S. Lloyd, F.R.C.V.S., Sheffield

NORTH WALES V.M.A.
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Meetings, First Tuesday, March and September

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Meetings, First Friday, Mar., June, Sept. and Dec.

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Southern Branch:

Pres. Sir Stewart Stockman, 4 Whitehall Place, S.W.
Sec. T. C. Toope, 34 High Street, Dover

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Pres. Mr. F. W. Willett, M.R.C.V.S., High Street, Staines
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122 St. George's Avenue, Tufnell Park, N.
Meetings, First Thursday in each month, except August and September, 10 Red Lion Square, Holborn, at 7 p.m

EASTERN COUNTIES V.M.A.
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New Buckenham
Meetings, Second Tuesday, Feb., July and Sept.

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Long Stanton, Cambridge
Hon. Sec: & Treas: Mr. Tom Hicks, M.R.C.V.S.,
Boston Road, Sleaford
Meetings, Second Thursday Feb., June, and October

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Pres: Mr. J. C. Coleman, M.R.C.V.S., Swindon
Hon. Sec. & Treas: Mr. G. P. Male, M.R.C.V.S., Reading
Meetings, Last Friday, Jan., April, July and Nov.

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Meetings, Last Thursday, Mar., June and Sept.

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Meetings, Third Thursday, March, July and November

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